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PROGRAMMED MATHEMATICS, DES MOINES HIGH SCHOOL.

BY- MORROW, THOMAS J.
NEW MEXICO WESTERN STATES SMALL SCHOOLS PROJECT

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PROGRAMED MATHEMATICS INSTRUCTION WAS USED OVER A TWO-YEAR PERIOD IN THE HIGH SCHOOL AT DES MOINES, NEW MEXICO. THE MAIN PURPOSE WAS TO OVERCOME MATHEMATICS LIMITATIONS OF THE COLLEGE-BOUND STUDENT FROM SMALL SCHOOLS AND TO OFFER NON COLLEGE-BOUND STUDENTS A SOUND MATHEMATICS BASE CURRICULA. THE TEST GROUP OF 46 STUDENTS BEGAN AT 3 DIFFERENT POINTS IN THE PROGRAM AND PROCEEDED INDIVIDUALLY. THE PROGRAMED COURSES USED WERE "MODERN MATHEMATICS, COURSE I" (SRA), "INTRODUCTION TO MODERN MATHEMATICS" (TMI GROLIER), AND "PROPERTIES OF NUMBER SYSTEMS, VOLUMES I AND II" (TMI GROLIER). PARENTS RECEIVED PROGRESS REPORTS ON THE STUDENTS RATHER THAN PERCENTAGE OR LETTER GRADES. EVALUATION OF THE PROJECT INDICATED FEW OPPORTUNITIES FOR INTERACTION BETWEEN TEACHER AND STUDENTS, AND STUDENT-REACTION CONTRIBUTIONS TO THE GROUP WERE LACKING. IT WAS CONCLUDED THAT PROGRAMED MATERIALS SHOULD SUPPLEMENT, AS ENRICHMENT FOR THE ABLE STUDENT AND ASSISTANCE FOR THE SLOW LEARNER, RATHER THEN REPLACE STANDARD INSTRUCTIONAL MATERIALS. (JEH)

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NEW MEXICO
Western States Small Schools Project

PROGRAMMED MATHEMATICS

DES MOINES HIGH SCHOOL

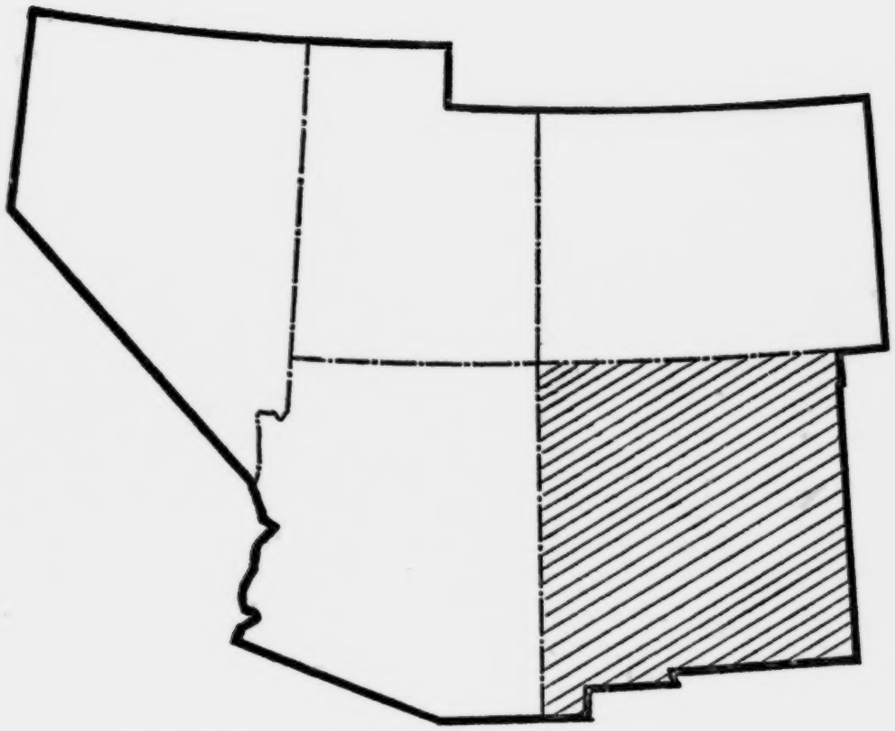

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TABLE OF CONTENTS

Page

FOREWORD 3

PROBLEMS AND OBJECTIVES 5

PROGRAMMED MATHEMATICS: ORGANIZATION AND ADMINISTRATION 6

Foreword

The purpose of this publication is to assist teachers and administrators contemplating the use of programmed mathematics in their schools. We hope to assist by reporting the classroom experience, with programmed mathematics, in the 1962-63 and 1963-64 school terms, of Mr. Thomas Morrow, who was then mathematics teacher at Des Moines High School.

This study was conducted under the auspices of the New Mexico Western States Small Schools Project, a project directed by the New Mexico State Department of Education and financed by the Ford Foundation.

The consultant for the study was Miss Lura Bennett, Specialist in Mathematics, New Mexico State Department of Education, who worked consistently with the teacher and the students.

DAN D. CHAVEZ
Project Director

Problems and Objectives

PROBLEMS

General:

1. Offering capable college bound students additional mathematics curricula beyond the two year system requirements
2. Offering non-college bound students a sound mathematics base curricula

Specific:

1. Inadequate time for planning and individual pupil aid
2. Inflexible scheduling possibilities
3. Little provision for individual differences
4. Time and energy of teacher spent in non-teaching duties

OBJECTIVES

General:

It is our purpose to:

1. Overcome some of the small schools mathematics limitations on the college bound student
2. Offer to non-college bound students a sound mathematics base curricula
3. Use a teacher aide in order to
   - 3.1 Give immediate reinforcement by test grading
   - 3.2 Free teacher for instruction
   - 3.3 Relieve teacher of clerical and monitor duties

Specific:

1. To provide for self-pacing
2. To encourage each student to accept personal responsibility
3. To encourage individual creativity
4. To provide for a transition from traditional to modern mathematics
5. To provide multi-class experience, such as Algebra I, Algebra II, and Trigonometry
6. To adjust the mathematics curricula for the college bound students to meet demands as indicated by progress of former students at college freshman and sophomore levels

Programmed Mathematics: Organization and Administration

By THOMAS J. MORROW

This section is divided into areas regarding the students, class organization, organization of class period time, content of the program and chapter tests, use of study booths, method of reporting to parents, granting of credit, criteria for grouping, general comments, comments on programmed instruction, and recommendations.

Programmed Courses Used

The programs used were as follows:

Program	*Publisher*
Modern Mathematics, Course I	Science Research Associates
Introduction to Modern Mathematics	TMI Grolier
Properties of Number Systems, Volumes I and II	TMI Grolier

The Students

This class consisted of 46 students of Des Moines High School. In this group there were 15 freshmen, 18 sophomores, 5 juniors, and 8 seniors. Twenty of the students were in their first year of programmed learning, twenty-six in their second year. The test group was divided into three sections.

The first section consisted of 9 sophomores who had completed one-half of SRA *Modern Mathematics, Course I* (Algebra I) the preceding year. These students had been given one credit in mathematics for that work with the understanding that they would complete the remainder of the course by January, 1964. All 9 completed the course on time and received a second credit for this work. The remainder of the year, these students had homework assignments in mathematics stressing the application of principles learned in the course.

The second section of 7 students, all freshmen, were considered above average in mathematics ability. These students were using programmed materials for the first time. This group was expected to compleete SRA *Modern Mathematics, Course I* during the 1963-64 school year. Of this group 3 completed the course; the remaining 4 lacked from two to eight chapters of completing the program.

The third section of 30 students were considered slow learners. There were 8 freshmen, 9 sophomores, 5 juniors, and 8 seniors in this group. They were expected to complete TMI Groliers *Introduction to Modern Mathematics* and *Properties of Number Systems, Volumes I and II*. Since most of the students finished this course in 6 weeks, 39 chapters were selected from SRA *Modern Mathematics, Course I* as additional material. These chapters were selected because they were easy enough for this group to do and also because they were built on ideas presented in the TMI Groliers program. The main idea was to provide continuity throughout, yet still provide most of the material found in first year Algebra courses. Ten completed the course, 18 did not finish, and 2 dropped out of school.

Criteria for Grouping

Students were grouped primarily on past English and mathematics grades. A second major consideration were the test results from ITED tests.

The English teacher was consulted in particular cases where reading capabilities were doubtful. Since I had had all of the students in preceding years, I was able to assess their abilities in mathematics and English and their work habits. While I realize there may be legitimate criticism of this method of grouping students, I feel it was as satisfactory a method as we were able to devise.

Class Organization

The students were scheduled into two different periods. Students scheduled their mathematics class for either of these periods on the basis of convenience.

Section A consisted of 13 students, all considered of low ability. They met five times a week, each period being 45 minutes long.

Section B consisted of 34 students. They met 5 times a week, each period 60 minutes long.

Organization of Class Period Time

The time within the period was far better controlled and better organized for section A than for section B. This was to be expected since section A had only 13 students, all of the same general ability, and all beginning at the same point in the same program. Section B had 34 students, of varying levels of ability, some beginning their first year in programmed materials, some their second year, some using TMI Grolier, and others using SRA.

Section A students all had homework assignments once a week; towards the end of the year, this was increased to three times a week. Lectures were provided as needed. Homework was discussed freely in class the day following assignment.

Section B students did not have required homework assignments with the exception of the 9 sophomores who had had previous programmed instruction. This group of 9 received homework assignments 3 times weekly the second semester. Lectures were not scheduled but were given individually as needed.

Content of the Program and Chapter Tests

Both TMI Groliers and SRA programmed courses have good sound material. Only one student had any difficulty with the TMI Grolier course. The SRA programmed course is definitely designed for the more able student; a student with a weak background in mathematics or low reading ability will encounter a great deal of difficulty.

While TMI does provide for pre- and post-tests, the post-test is merely a repetition of the pre-test. This seems to encourage studying for the test. Improvement could be made by providing different pre- and post-tests.

One student took 30 weeks to complete the TMI Grolier courses. This combination of TMI Grolier and SRA seems to make a very good basic course for slow learners, enabling them to complete an Algebra I course the following year with some success.

The weakest aspect of the SRA course is definitely the chapter tests. Besides being unduly difficult at times, all tests are multiple choice. There is no opportunity afforded for pre-testing. Accompanying material states that the program is designed for 7th grade reading level. I feel that a 9th grade reading level is a more realistic appraisal.

Use of Study Booths (Student Carrels)

A student questionnaire completed by 37 of the students at the end of the year showed 26 in favor of individual student carrels and 11 opposed to their use. The most prevalent comment was that more work was accomplished in the carrels.

Discipline is more easily maintained in the carrels; otherwise, I see no advantage to the teacher.

Method of Reporting to Parents

Parents received progress reports from the school every six weeks. These reports showed where the student was in relation to where he should be. Parents were informed as to whether this progress was satisfactory in view of the student's capabilities. After 2 years of reporting progress in this manner rather than with a letter or percentage grade, the parents' only comments were: "Is my son making an A or a C?" or, "Is my daughter going to get a credit?"

Comments on Method of Reporting

Much more research must be done on when, how, or whether these reports are to be converted to conventional grades.

Concerted action must be taken to educate the parents as to the meaning of these reports and their bearing on future plans such as college entrance. Indeed, we must clarify to ourselves the meaning of these reports and perhaps revise our entire grading and diploma system. Since the student who laboriously completes 3 units has theoretically digested it before he is able to proceed, then the quality of his work is patently the same as that of the student who with less difficulty has completed 5 units in the same length of time. Since the theory is that both students have mastered what they have grasped, then the difference between them lies not in the quality (or grade) of their work but in the ability with which they handled it. Perhaps a solution may be to offer several types of diplomas at graduation: one type for the student who plugged along gleaning a minimum of what was offered, another for the average and a third for the exceptional.

Granting of Credit

One unit of credit was granted to all students who had completed Introduction to *Modern Mathematics, Properties of Number Systems,* and selected chapters of *Modern Mathematics, Course I.* All students received a credit except one who was extremely slow; he received ½ credit. In one year's time he had completed TMI Groliers *Intro-*

duction to Modern Mathematics and *Properties of Number Systems, Volumes I* and II. Final grades were given on the basis of total amount of material covered, ability, work habits and a four-day final test which covered material presented in the SRA modern mathematics course.

General Comments on the Use of Programmed Materials

Personally, I feel that too many students are missing too much of the teacher-pupil relationship and the closeness which comes from a regular classroom situation. The students also miss greatly the contributions by both gifted and less able pupils to the group's total experience in the mathematics course. Perhaps this feeling can best be illustrated by the following:

On the student questionnaire concerning programmed materials completed at the end of the year, the following question was asked: "Would you prefer to learn from a regular textbook in a regular class?" One student answered, "Yes, if the teacher was like you."

I feel that the student just isn't getting all he could or should. Furthermore, I find that I, too, am on the losing end; this loss of personal contact takes away much of the joy of teaching. Far too much of the work involved is automatic.

If I were to continue the program, the following plan would be followed:

1. Students would be grouped, using the same guide-lines as before.
2. The course content would be sectioned and each student would be expected to be at a certain point in the program at the end of each six weeks. Each student would be told at the beginning of the year just where he should be at the report periods. The number of chapters a student would be expected to cover would depend on his ability.
3. Students would be able to take chapter tests only once. (At present, students repeat chapter tests until a passing grade is received.) Well-constructed, teacher-made tests would be offered and once taken, the student would proceed to the next chapter.
4. At the end of six weeks, the chapter test grades received during that time would be averaged and that grade would be sent home along with the progress report.
5. At least two sections of programmed modern mathematics would be offered: one section for average and above average and the other for low ability students. Students in each group would not be permitted to scatter so much in the texts. I believe that this could be controlled by having homework 3 or 4 nights a week.
6. One day a week would be set aside as a "work" session. The students would go to the board and work problems; good students would explain main ideas in a chapter to the average, etc. I would not set a permanent day for this but rotate it.

Comments on Programmed Instruction

Programmed materials will definitely serve a purpose in the school system. It is merely a matter of finding out where their greatest value lies. Personally, I feel that their greatest value would be as supplementary material in a regular classroom situation. Programs could be designed which would expand on a certain single idea presented in the textbook for the benefit of the more able student. Other programs could be designed for the slow learner, giving him a slower pitch of some elusive point.

I do not believe that programmed learning should be allowed to set the classroom scene or dictate teaching methods, but I do believe it is a bright new tool whose uses and limitations must be cautiously defined.

Recommendations

1. Any teacher contemplating using programmed mathematics should contact the Specialist in Mathematics of the State Department of Education.
2. Course extension should include practical applications of what has been learned.
3. Entire course content should be preplanned into one course by the teacher.
4. Teachers using the same programmed course should meet and discuss problems arising from the specific programmed course.